A Quality and Technology Network

Decontamination of “GABROS BEJA” Aquifer using an Integrated System of Renewable Energies

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instituto de soldadura e qualidade

Outline

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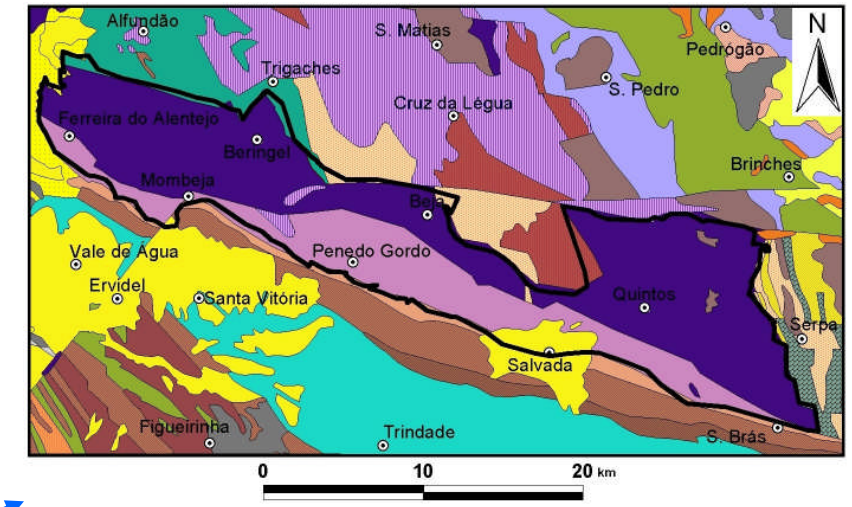
2. SAFEWATER Project
3. Project objectives
4. Project partners
5. Description of the workprogramme
6. Funding

1. GABROS - BEJA aquifer – General Info



GABROS BEJA (A9)

Identification

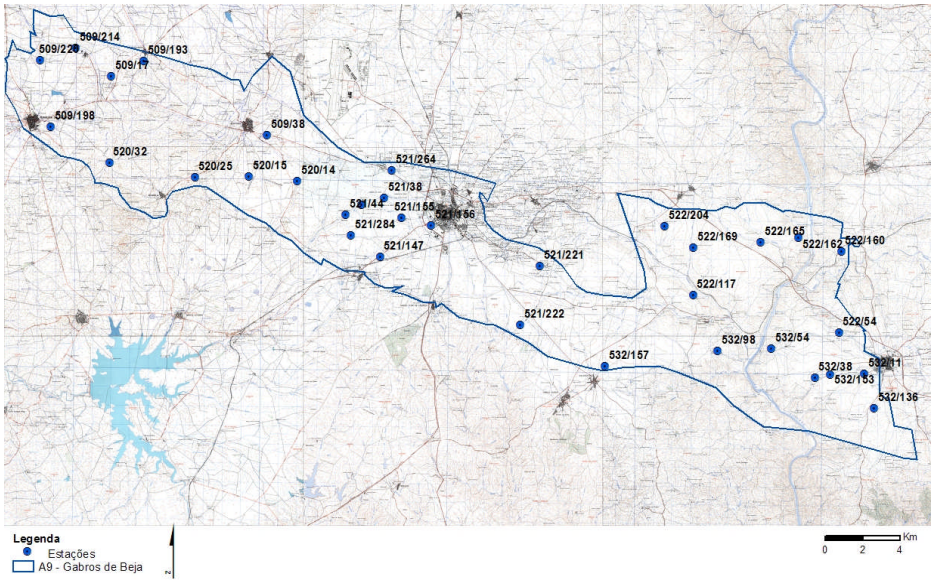
Hydrological Basin (watershed)	Guadiana and Sado
Municipality	Beja, Ferreira do Alentejo, Serpa
Area	387 km²
DRAOT (Environmental and Spatial Planning Regional Direction)	Alentejo

Hydrogeology

Predominant Aquifer formations	Beja Igneous Complex and Beja-Acebuches Ophiolitic Complex (ante-Viseano)
Dominant Lithology	Gabbros, anorthosites, serpentinites, basic metavolcanics, with thickness not greater than 50 meters
General Characteristics	System essentially with fissures, with some porous rock characteristics General presentation of unconfined aquifer
Productivity (l/s)	Median =3,2
Hydraulic Parameters	Transmissivity mean=39 m^2/day
Hydraulic operation	The superficial part is comprised by an altered zone with a medium thickness of 22 meters, and underlying is a cracked area with a thickness of 40 to 60 meters. The circulation is mostly done in the alteration zone.
Piezometric / Flow Directions	The underground outflow is done from the region of Beja to west and east. The Guadiana valley is the preferential zone for discharge.
Groundwater inventory	Input =9 hm^3/year; known output =9 hm^3/year
Chemical Facies	Calcic bicarbonated facies or calco-magnesian facies.

MONITORING CAMPAIGN

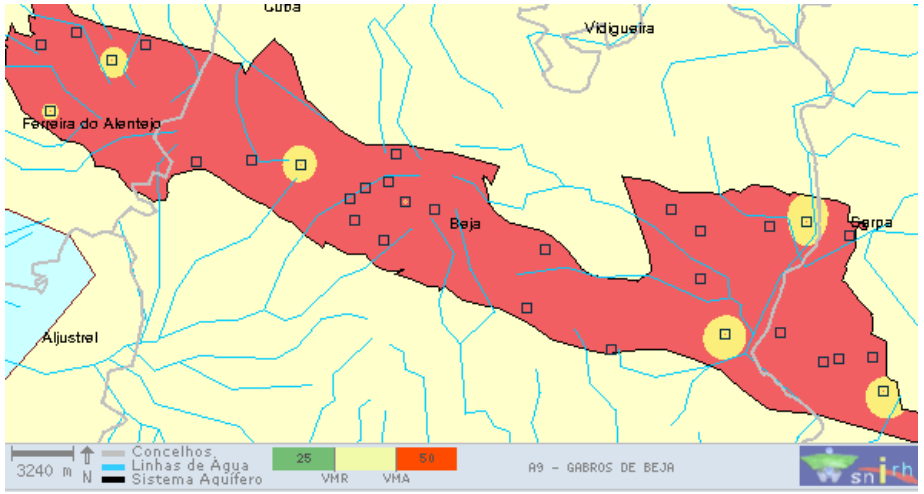
This underground water has a monitoring programme associated that started in 2000. Nowadays in order to evaluate the evolution of nitrate contents, 34 stations are closely controled, 19 vertical drills, 14 shafts and 1 spring. Sampling is made every 6 months.



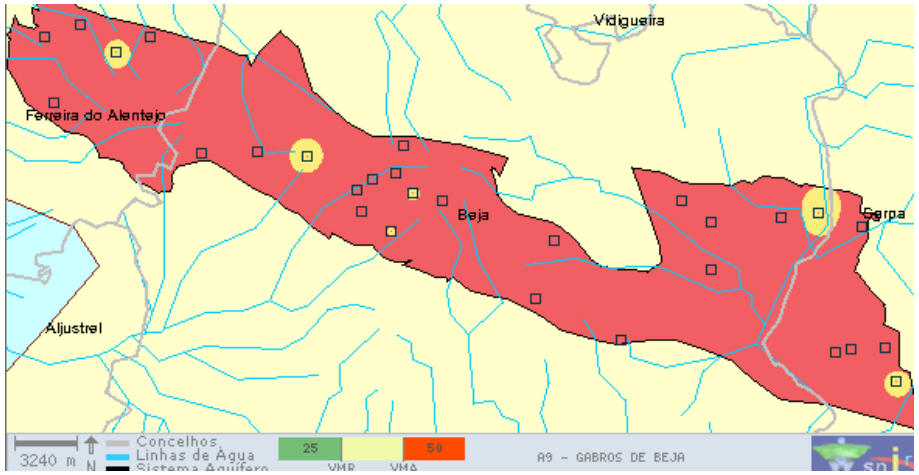
NITRATES CONTENT

From the monitoring programme should be pointed out the high concentration of nitrates above the legal limits (50 mg/l) in all the aquifer.

It was also identified a slight increase of contaminated area from 2005 to 2006, from 94.9% up to 96.9%, respectively



Nitrates concentration distribution in 2005



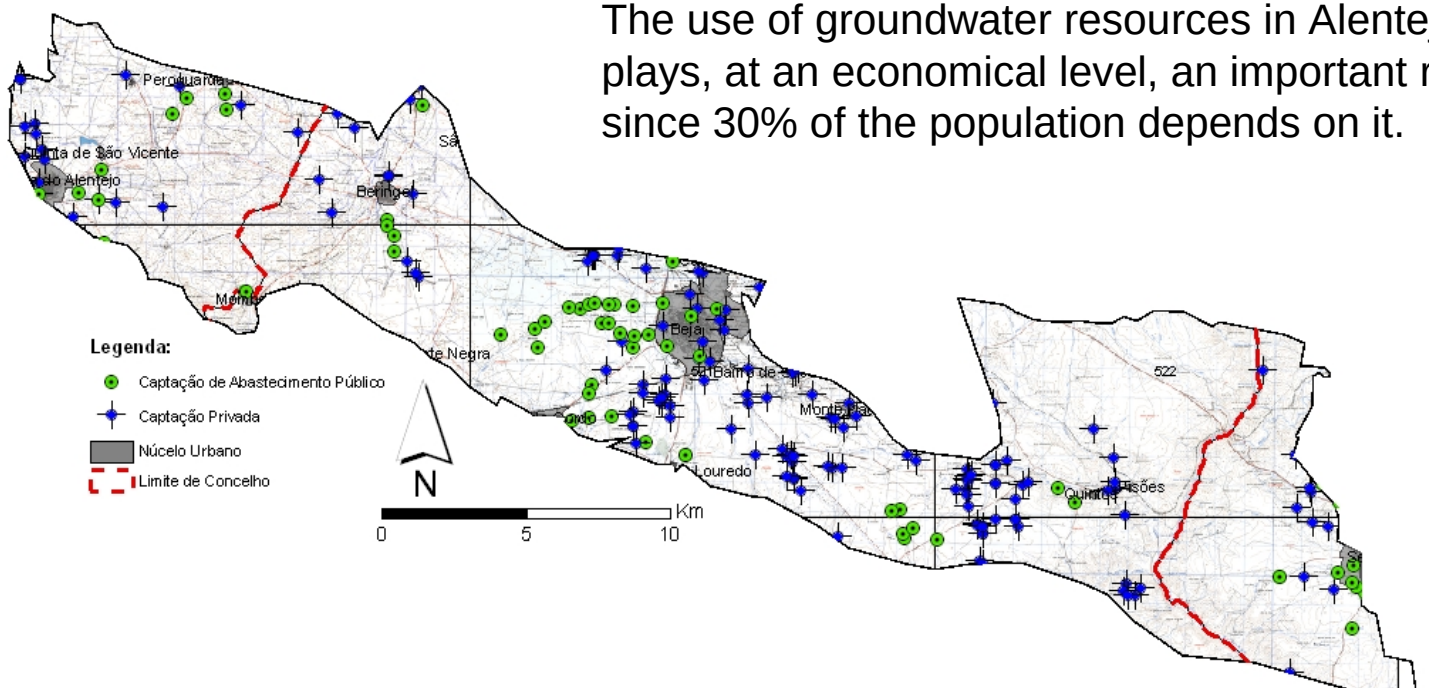
Nitrates concentration distribution in 2006

WATER USAGE

The use of the resources are mostly dedicated to public suply of populations, agricultural practices and to some small industries.

Concelho	Habitantes	Volumes Anuais (m^3/ano)	Nº Pólos de Captação	Nº de Captações
Ferreira do Alentejo	5538	1107600	2	8
Beja	29909	1058537	6	40
Serpa	Avaliação em curso		2	12

Fonte: Entidade gestora



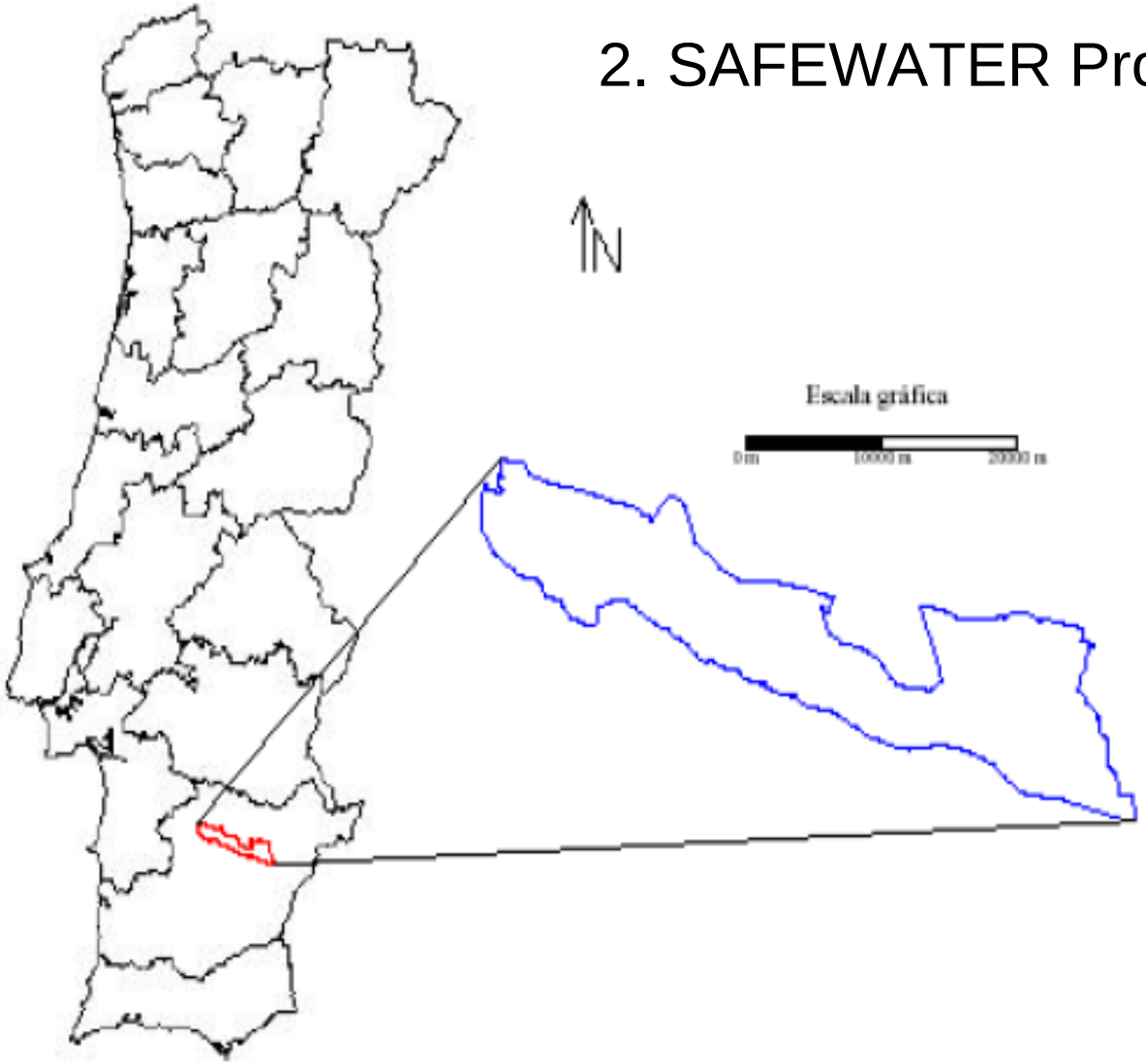
The use of groundwater resources in Alentejo plays, at an economical level, an important role since 30% of the population depends on it.

DESERTIFICATION

Since Middle Age up to the end of 20th Century, successive land use changes resulted mainly on the increment of land devoted to agricultural activities (cereals), livestock production and grazing, resulted on the drastic reduction of natural vegetation.

Present levels of degradation of land resources and rural landscape in South Interior Alentejo, Portugal, are the **irrefutable result of centuries of human impact** and had extensive and negative consequences on the environment, through the destruction of natural shrub vegetation cover and ancient oak forest.

2. SAFEWATER Project



SAFEWATER Project main goals

1 . Develop an innovative integrated renewable energy power system to feed a groundwater treatment system for contaminants removal (nitrates)

2. The system will consist of various forms of renewable energy and storage technologies.

3. Management and control software, which allows real time monitorization of all equipments.

4. Operational management of the integrated equipments, as well as of the renewable energy sources.

5. Decision support system for the management of produced excess energy.

6. Replicability and economic viability study

Partnership

EMAS, EM is responsible for the management and exploitation of the public water systems, treatment and distribution of water for domestic consumption as well as the management and exploitation of the public systems and treatment of residual waters in Beja Municipality

EDP is one of largets companies in Portugal and one of largest players in the world for renewables energy. Major investments are being made.

ISQ is the largest R&D institution in Portugal as well as a service provider for several technological areas.

workprogramme

Preliminary studies	- Environmental Impact study - Aquifer characterization - Energy resources - Viability and replicability
Technical specs	- Underground water, aquifer - Energy - Integration
Knowledge and capabilities	- Underground water treatment technologies - Energy System Design
Development	- Underground water treatment system development -Energy System Development
Prototype assembly and pilot installation	- Underground water treatment system implementation - Energy System implementation - System Integration
Tests	- System Validation
Dissemination	- Dissemination Activities

1

Preliminary studies

- Environmental Impact study
- Aquifer characterization
- **Energy resources**
- **Viability and replicability**

Identify the scale of the problem and its ecological impact

Gather all the information and available data for an additional characterisation of the site.

Identification of the proper amount of water to be treated and recycled to underground re-injection in a long term perspective

Physical characterisation of the water collecting points.

Evaluation of energy resources, in particular solar and wind. This area in Portugal has the largest solar exposure in Europe.

Identification of the technologies available

1	**Preliminary studies**	**- Environmental Impact study** **- Aquifer characterization** - **Energy resources** - **Viability and replicability**

Economical viability study will be performed in order to evaluate the relation cost/benefit of the integrated decontamination solution.

Replicabilty will also be evaluated to study the possibilty of using the system in remote scenarios where accessing water can be very dificult

Projective study, considering the technologies and the aquifer characteristics in order to identify the time necessary to remove the contaminants from the underground water.

2	**Technical Specs**	**- Underground water, aquifer** **- Energy** **- Integration**

Monitoring programme aiming at quantifacation of toxic substances of organic and inorganic sources.

Access evaluation to the place where the integrated prototype will be assembled.

Identification of all the legal requirements for the implementation of the different technologies.

The renewable resources are **not always available** therefore is necessary to evaluate, based on the energy requirements of the prototype and energy availability, the technology available for **storage** which is more suitable to system specs in order to allow the system to work in a continuous way

2	**Technical specs**	**- Underground water, aquifer** **- Energy** **- Integration**

Definition of the renewable system integration architecture as well storage. Availability is an important issue as well as overall eficiency of the energy production instalation.

Underground water decontamination system

Operational parameters

Energy system

Remote management software and decision support system tool

Integration Spec

3

Knowledge and capabilities

- **Underground water treatment technologies**

- **Energy System Design**

Development of a proposal for the prototype development having into account the best practices, the technology and legislation.

In order to fit the environmental legal requirements, the integrated technology should consider several issues:

Soil
Waste production
Material recycling
Reuse of absorbent materials
Membranes
Noise level
Energy efficiency

4 Development

- **Underground water treatment system development**

-**Energy System Development**

Development and design of the integrated systems of underground water treatment.

Development of a pilot scale system for the SAGB treatment.

The prototype should be made of modular parts in order to allow a permanent update of the system.

5	**Prototype assembly and pilot installation**	- **Underground water treatment system implementation** - **Energy System implementation** - **System Integration**

Construction of the necessary infrastructures.

System implementation “in situ” as well as monitoring system.

Integration of the different systems, water, energy, monitoring system, remote management software.

The pilot instalation/prototype will be placed in “Sistema Aquífero Gabros de Beja”, Portugal, classified as a vulnerable area according to the European Directive 91/676/CEE.

6 Tests - System Validation

System validation
Software validation

Tests will be carried out in order to turn the system operational.

7 Dissemination - Dissemination Activities

Awareness actions will be carried out for the population in general

workshops organisation,

Internet site development

Project driving force

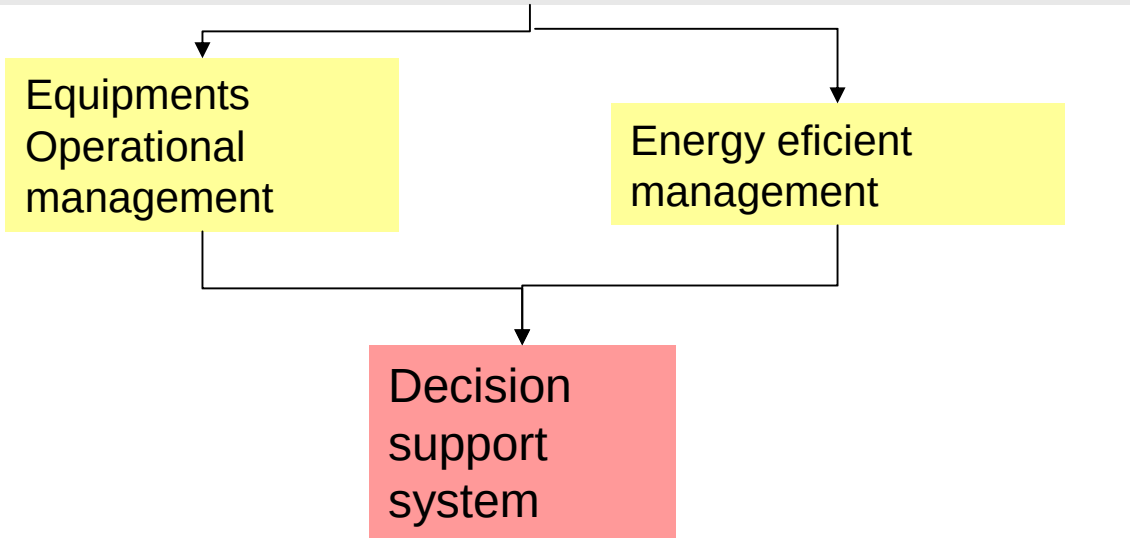
Sustainable development

- Managing water usage and waste
- EU strategies for the proper use of fertilizers and pesticides
- Development of environmental friendly low cost solutions

New technological concepts for the production and integration of renewable energies associated to water treatment systems

Project innovation

Remote control management system for real time monitoring of the different components of the integrated system

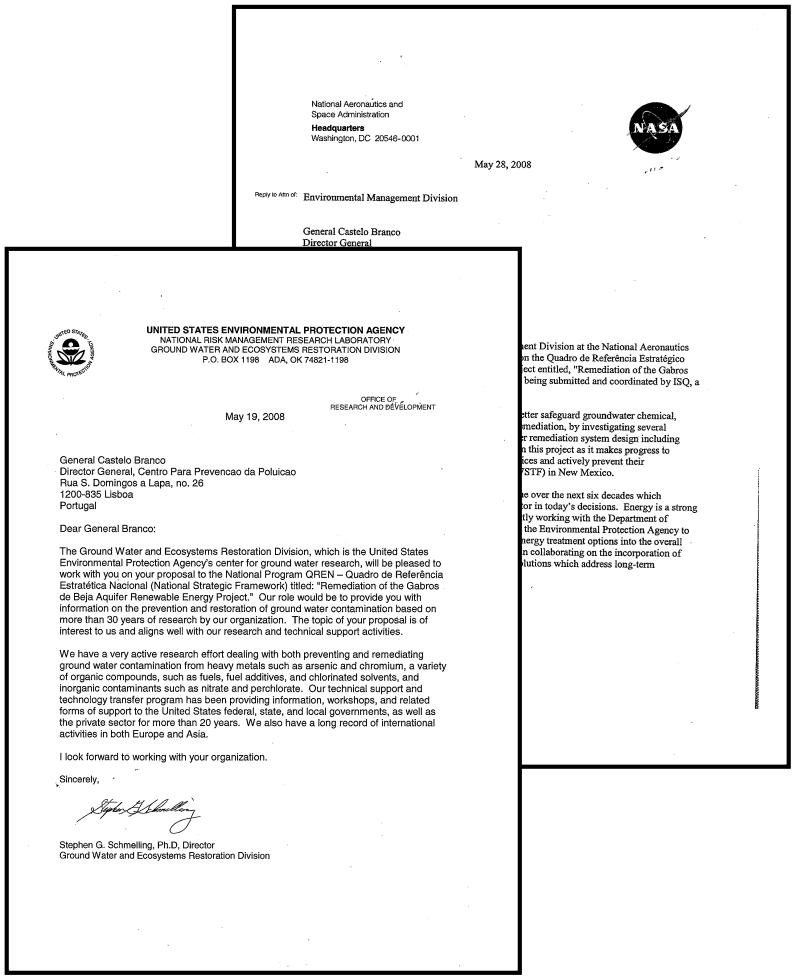


Project Schedule

SAFEWATER																																														
Tarefas	Actividades							Promotores			Calendário Projecto / Ano Civil																																			
											Ano 1												Ano 2												Ano 3											
	1. Estudos	2. Especificações Técnicas	3. Pre´Desenvolvimento	4. Desenvolvimento	5. Prtotótipos	6. Testes	7. Promoção	0. EMAS	1. ISQ	2. EDP	m1	m2	m3	m4	m5	m6	m7	m8	m9	m10	m11	m12	m13	m14	m15	m16	m17	m18	m19	m20	m21	m22	m23	m24	m25	m26	m27	m28	m29	m30	m31	m32	m33	m34	m36	m36
											2008						2009												2010												2011					
											J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
A. Impacte Ambiental	X							X	X	X	A.1																																			
B. Águas Subterrâneas/Aquífero	X	X	X	X	X	X	X	X	X		B.1						B.2				B.3								B.4						B.5											
C. Energia	X	X	X	X	X	X	X	X	X	X							C.1			C.2						C.3									C.4						C.5					
D. Integração		X			X	X	X	X	X	X																D.2																		D.5		
E. Viabilidade e Replicabilidade	X						X	X	X	X																																		E.1		
Testes																																BCD.6														
Promoção																																									BCDE.7					
											m1	m2	m3	m4	m5	m6	m7	m8	m9	m10	m11	m12	m13	m14	m15	m16	m17	m18	m19	m20	m21	m22	m23	m24	m25	m26	m27	m28	m29	m30	m31	m32	m33	m34	m36	m36

Duration: 3 years

International partnership



National Aeronautics and Space Administration
Headquarters
Washington, DC 20546-0001

May 28, 2008

Reply to Attn of: Environmental Management Division

General Castelo Branco
Director General

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
GROUND WATER AND ECOSYSTEMS RESTORATION DIVISION
P.O. BOX 1198 ADA, OK 74821-1198

OFFICE OF
RESEARCH AND DEVELOPMENT

May 19, 2008

General Castelo Branco
Director General, Centro Para Prevencao da Poluicao
Rua S. Domingos a Lapa, no. 26
1200-835 Lisboa
Portugal

Dear General Branco:

The Ground Water and Ecosystems Restoration Division, which is the United States Environmental Protection Agency's center for ground water research, will be pleased to work with you on your proposal to the National Program QREN – Quadro de Referência Estratética Nacional (National Strategic Framework) titled: "Remediation of the Gabros de Beja Aquifer Renewable Energy Project." Our role would be to provide you with information on the prevention and restoration of ground water contamination based on more than 30 years of research by our organization. The topic of your proposal is of interest to us and aligns well with our research and technical support activities.

We have a very active research effort dealing with both preventing and remediating ground water contamination from heavy metals such as arsenic and chromium, a variety of organic compounds, such as fuels, fuel additives, and chlorinated solvents, and inorganic contaminants such as nitrate and perchlorate. Our technical support and technology transfer program has been providing information, workshops, and related forms of support to the United States federal, state, and local governments, as well as the private sector for more than 20 years. We also have a long record of international activities in both Europe and Asia.

I look forward to working with your organization.

Sincerely,

Stephen G. Schmelling, Ph.D, Director
Ground Water and Ecosystems Restoration Division

1	**Preliminary studies**
2	**Technical specs**
3	**Knowledge and capabilities**
4	**Development**
5	**Prototype assembly and pilot installation**
6	**Tests**

“In the future, if nothing changes, water will play the role, oil plays today”

Daniel Zimmer

A Technology and Quality Network

Obrigada!
Thank you!

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www.isq.pt